Exelon Generation Company, LLC
Byron Station
4450 North German Church Road
Byron, IL 61010-9794

www.exeloncorp.com

Exelon Nuclear

March 28, 2001

LTR: BYRON 2001-0054
File: 3.03.0800

United States Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Byron Station, Unit 1
Facility Operating License No. NPF-37
NRC Docket No. STN 50-454

Subject: Supplement to Licensee Event Report (LER) Unit 1-2000-003-00

Enclosed is a supplement to the subject LER. The root cause investigation for the event was revised subsequent to the submittal of the original LER. This supplement contains the pertinent revised root cause information. In addition, the Safety Analysis Section was revised to reflect a re-analysis of the risk assessment.

If you need any additional information concerning this report, please contact Ms. P. Reister, Regulatory Assurance Manager, at (815) 234-5441, extension 2280.

Sincerely,

Richard P. Lopriore
Site Vice President
Byron Nuclear Generating Station

RPL/JL/dpk

Enclosure: Byron Station Unit 1 LER 2000-003-01

cc: Regional Administrator – NRC Region III
Senior Resident Inspector – Byron Station

IE22

NRC FORM 366 (6-1998) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 06/30/2001

Estimated burden per response to comply with this mandatory information collection request: 50 hrs. Reported lessons learned are incorporated into the licensing process and fed back to industry. Forward comments regarding burden estimate to the information and Records Management Branch (t-6 f33), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, and to the Paperwork Reduction Project (3150-0104), Office Of Management And Budget, Washington, DC 20503. If an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Byron, Unit 1	STN 05000454	1 of 9

TITLE (4) Unintentional Violation of Low Temperature Over Pressure Protection System Technical Specification Due to Operator Error

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
10	08	2000	2000	- 003 -	01	03	28	2001	FACILITY NAME	DOCKET NUMBER

OPERATING MODE (9)	MODE 1
POWER LEVEL (10)	100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) **(11)**

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(iii)	☐ 73.71(b)
☐ 20.2203(a)(1)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(iv)	☐ 73.71(c)
☐ 20.2203(a)(2)(i)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(v)	☐ OTHER
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)	☐ 50.73(a)(2)(vii)	
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(viii)(A)	(Specify in Abstract below or in NRC Form 366A)
☐ 20.2203(a)(2)(iv)	☒ 50.73(a)(2)(i)	☐ 50.73(a)(2)(viii)(B)	
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(ii)	☐ 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Penny Reister, Regulatory Assurance Manager	(815) 234-5441 X2280

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) **(16)**

Byron Station Technical Specification 3.4.12, "Low Temperature Over Pressure Protection (LTOP) System," contains requirements for both adequate pressure relieving devices and controls to prevent mass addition into the RCS. The mass addition controls include, in part, requiring the Safety Injection (SI) pumps to be incapable of injecting into the RCS. One method of ensuring this condition is to have two independent means to prevent a mass addition. On October 8, 2000, Byron Station Unit 1 was in Mode 5 and preparing to fill the SI Accumulators using the 1A SI pump. The operating procedure used to perform this evolution contained an approved change to allow flexibility in LTOP compliance requirements. At 2125 hours, the licensed operator performing the procedure improperly restored an isolation valve being used for LTOP compliance to the open position. This action violated the two independent means of mass addition criterion. This situation was recognized approximately 4 hours later and immediately corrected. The causes of the event were the inappropriate application of human performance error reduction techniques used by the operator and that operators' fundamental practices relax during outage periods. Several other contributing causes were identified such as an inadequate pre-job briefing and weak operator knowledge of LTOP requirements. Corrective actions include removing the operator from shift duties pending remediation, operator training to improve fundamental practices and redefining key on-shift Operations Management roles and responsibilities during unit outages. There were no adverse safety consequences with this event. The control switch for 1A SI pump was always in the pull to lock position. All the relief devices required by the LTOP Technical Specification were operable and fully capable of mitigating an inadvertent mass addition from the 1A SI pump. This event is reportable to the NRC in accordance with 10 CFR 50.73(a)(2)(i)(B).

A. Plant Conditions Prior to Event:

Event Date/Time: October 8, 2000/2125 hours

Unit 1 - Mode 5 - Cold Shutdown, Reactor Power: 000%

Reactor Coolant System (RCS) [AB]: Temperature/Pressure - 180 degrees F/355 psig. RCS Pressurizer level was greater than 5%. No other systems or components were inoperable at the time of this event that contributed to this event.

B. Description of Event:

Byron Station Technical Specification 3.4.12, "Low Temperature Over Pressure Protection (LTOP) System," contains requirements for both adequate pressure relieving devices and controls to prevent mass addition into the RCS. The mass addition controls include, in part, requiring the Safety Injection (SI) [BQ] pumps to be incapable of injecting into the RCS. The preferred method of rendering the SI pumps incapable of injecting into the RCS is by removing power from the pump's motor by racking out its electrical breaker under administrative control. However, alternate methods are allowed for those situations when the SI pumps need to be available or operated provided at least two independent means exists to prevent a mass addition such that a single failure or action will not result in an injection into the RCS. For example, an SI pump's motor may have its breaker racked in, provided the pump's control switch is in the Pull to Lock (PTL) position and at least one isolation valve is closed in each flow path to the RCS, or the SI pump may be operated provided an isolation valve is closed and de-energized in each flowpath to the RCS. This specification is applicable in Mode 4 (i.e., Hot Shutdown), Mode 5, (i.e., Cold Shutdown) and Mode 6 (i.e., Refueling) with the Reactor Vessel head on the Reactor.

On October 8, 2000, at approximately 1930 hours, the activity to fill the SI Accumulators was ready to begin. This is accomplished using Byron Operations Procedure (BOP) SI-5, "Raising the SI Accumulator Level with SI Pumps." This activity was assigned to an extra licensed nuclear station operator (NSO-X) and would involve the licensed Unit 1 nuclear station operator (U1 NSO), the Unit 1 licensed control room supervisor (U1 SRO), and a non-licensed operator (NLO).

B. Description of Event (continued):

At 2000 hours, a pre-job briefing for the SI Accumulator fill evolution was held; however, the U1 NSO did not participate due to other outage activities. After the pre-job brief at approximately 2020 hours, the U1 NSO expressed to the U1 SRO that a weakness existed in BOP SI-5 in that it was overly restrictive in ensuring compliance to the LTOP Technical Specification. The U1 NSO reasoned that if more flexibility was allowed in which isolation valves could be used to satisfy the LTOP requirements, then manpower could be saved from having to de-energize an extra valve.

BOP-SI-5 ensured LTOP compliance for the 1A SI pump by closing and de-energizing valves 1SI8835, 1SI88802A, and 1SI8802B (refer to Figure 1). However, LTOP compliance for the 1A SI pump could be also be ensured by only closing and de-energizing 1SI8802A and 1SI8821A. In addition, a similar procedure change to improve LTOP flexibility was successfully used to the same procedure a few days before while attempting to fill the SI Accumulators. The U1 SRO and Shift Manager concurred and authorized a procedure change to allow, but not require, the option to substitute 1SI8821A for 1SI8835 and 1SI8802B. The change did not address the restoration. The U1 SRO later stated that he intentionally did not address 1SI8821A in the restoration step to ensure it would remain closed and de-energized. This possibility of changing the procedure was not discussed at the pre-job brief.

In an effort to aid NSO-X, at 2025 hours, the U1 SRO directed the U1 NSO to close and de-energize 1SI8821A as one of the options for LTOP compliance as allowed by the procedure change to BOP-SI-5. However, at this time NSO-X was unaware of this action because he was engaged in briefing the NLO to rack in the breaker for the 1A SI pump's motor. Though he became aware that SI8821A was closed and de-energized, he was not fully aware that the closing of 1SI8821A was for LTOP compliance. At this point NSO-X decided to close but not de-energize 1SI8835 as an extra LTOP precaution. This was allowed by the procedure change. At 2103 hours, the 1A SI Pump was started by NSO-X and the SI Accumulators were filled as intended. At 2110 hours, the SI pump was secured and its control switch placed in the PTL position in accordance with BOP-SI-5.

B. Description of Event (continued):

At 2111 hours, NSO-X was at a restoration step, not altered by the procedure change, that required 1SI8835 to be energized and opened if it was previously closed by the procedure and if RCS temperature was greater than 330 degrees F. He misread this step and missed the RCS temperature conditional requirement and believed the procedure directed him to open 1SI8835. Confused at this point, he asked the U1 SRO if he should open 1SI8835 and, in addition, asked if the 1A SI pump should be aligned as found initially. The U1 SRO answered briefly in the affirmative believing that since 1SI8835 was an optional valve for LTOP compliance, as allowed by the procedure change, it was acceptable to return it open and that 1SI8821A would continue to provide LTOP compliance. This rationale was not communicated to NSO-X. The U1 SRO was unaware NSO-X was also seeking guidance to open 1SI8821A. Since NSO-X was not fully aware that 1SI8821A was closed and de-energized for LTOP compliance, NSO-X mistook this short affirmative answer from the U1 SRO as permission to open 1SI8835 and to energize and open the 1SI8821A.

At approximately 2125 hours when 1SI8821A was opened, a direct flow path existed from the 1A SI pump to the RCS cold legs. With the 1A SI pump's motor breaker racked in and the control switch in PTL, two independent means to prevent a mass addition into the RCS did not exist. This condition is in non-compliance with Technical Specifications 3.4.12. On October 9, 2000, at 0129 hours while performing a routine Unit 1 Main Control Board walkdown, another licensed operator not involved in the Accumulator fill evolution discovered the non-compliant situation. 1SI8821A was immediately closed, which restored compliance to Technical Specification 3.4.12. This condition existed for approximately 4 hours and is a condition prohibited by Technical Specification and accordingly, reportable to the NRC in accordance with 10 CFR 50.73(a)(2)(i)(B).

C. Cause of Event:

Two root causes were determined for this event. The first root cause was the inappropriate application of human error reduction techniques by NSO-X. The second root cause is that operators' fundamental practices relax during outage periods. These root causes resulted in several inappropriate actions. These actions include:

C. Cause of Event (continued):

1) Misreading a BOP-SI-5 procedure step believing it authorized the opening of 1SI8835 with the RCS temperature less than 330°F.

2) Energizing and opening 1SI8821A without procedural direction to do so.

3) Failing to utilize expected communication standards while communicating to the U1 SRO during the restoration steps of the procedure

4) Performing of the task without complete and clear understanding of LTOP requirements.

5) Poor techniques used to place keep while executing BOP-SI-5 procedure steps during the course of the procedure performance.

Several other causes contributed to this event:

1) NSO-X demonstrated a weakness in expected LTOP knowledge. Based on his licensed operator training, Operations Management would have expected him to realize that his intended actions would violate LTOP compliance.

2) The procedure change was inappropriately applied to this evolution. The procedure governing the change process used in this situation allows for it only to be used when a procedure cannot be performed as written due to plant conditions. BOP-SI-5 could have been performed as written. The basis for the change request was to use NLO resources more efficiently. In addition, the changed step of the procedure was flagged as satisfying a station commitment from a 1994 LER (see section F). Modifying a commitment is considered a change of intent to the procedure. The procedure change process used in this situation does not allow the change of intent of a procedure. The procedure change to BOP-SI-5 on October 6, 2000, was appropriate and successfully completed.

3) The procedure change was written containing non-specific and flexible direction allowing for different options for LTOP compliance. It failed to provide precise direction similar to typical procedural steps and failed to provide a clear description of its intent.

C. **Cause of Event (continued):**

4) The procedure change form was attached to the front of the procedure and was not incorporated into the procedure step affected. This is a human error prevention weakness in that the procedure performer has to remember which steps are affected.

5) An inadequate pre-job briefing was conducted in that the intent to change the procedure was not covered and another briefing was not held when the U1 SRO and U1 NSO decided to change the procedure

6) NSO-X, U1 NSO, U1 SRO and the Shift Manager failed to recognize the procedure change process chosen to make this change was improper in that the procedure could have been executed as written and it was attempting to change the intent of the procedure.

7) The U1 SRO failed to utilize and enforce expected communication standards when communicating with NSO-X at the time of restoration of the procedure.

8) The U1 SRO inappropriately directed the U1 NSO to execute a procedure step for a procedure he was not directly performing. This occurred when he directed the U1 NSO to close and de-energize 1SI8821A.

9) The U1 SRO and U1 NSO failed to properly brief NSO-X of the actions they took and their intent when they closed and de-energized 1SI8821A.

10) Latent procedural weaknesses existed in BOP-SI-5 in that it contained wording that is not well human-factored and the procedure did not specifically return the SI pump to the preferred LTOP compliance state of removing power from the pump.

D. **Safety Analysis:**

There were no adverse safety consequences with this event. The 1B SI pump had power removed under administrative control and the 1A SI pump was always in the pull to lock condition during the time the flowpath existed to the RCS. The 1A SI pump could not have automatically started. All the relief devices required by the LTOP Technical Specification were operable and fully capable of mitigating an inadvertent mass addition from the 1A SI pump. If any relief device had actuated and failed to re-close, each could have been isolated to prevent a loss of RCS event.

D. Safety Analysis (continued):

A bounding risk analysis was done to estimate the risks associated with this event. The total risk to core damage attributed to the event (i.e., change in core damage probability) was determined to be substantially less than 1E-06/yr. This is considered to be not risk significant.

E. Corrective Actions:

NSO-X was removed from shift duties until sufficiently remediated in human error reduction techniques.

Since this event involved weaknesses in several expected fundamental operator practices, the Operations Manager will require operators to receive training on this event to reinforce fundamental human performance expectations and demonstrate how poor execution of fundamental practices can result in very serious consequences.

The Operations Manager has redefined roles and responsibilities of key on-shift Operations personnel during unit outage periods to ensure expectations of utilizing fundamental practices are enforced. This re-definition includes freeing the outage unit SRO from performing specific outage tasks, which will allow that SRO to oversee all activities and ensure fundamental practices are being used. The Shift Manager will also have increased responsibility for observing control room personnel and ensuring fundamental practices are being utilized.

Operators will receive training on the proper use of the procedure change process that was used improperly.

Licensed operators will receive simulator training on challenging outage configurations to include SI accumulator fill operations while in LTOP plant conditions.

Licensed operators will receive remedial training on LTOP requirements to include its bases and acceptable methods to ensure compliance.

E. Corrective Actions (continued):

The administrative process for procedural changes will be reviewed to ensure sufficient controls are in place and to ensure changes are properly incorporated into the procedure being changed. In addition, appropriate procedures/polices will be revised to clearly define expectations for procedural place keeping techniques.

BOP-SI-5 will be reviewed and revised, as appropriate, to correct wording weaknesses and to provide enhanced controls for LTOP compliance.

F. Previous Occurrences:

LER Number	Title
454 1994-018-00	"Operation of a Safety Injection Pump in Mode 4 Without Two Modes of Isolation from the RCS Due to Personnel Error"

This event involved the operators failing to recognize that 1SI8835 also had to be de-energized while running the SI pump to satisfy the two independent means criterion to prevent a mass addition. This requirement was overlooked by the Operators involved because it was contained in a footnote to the step in BOP-SI-5. As a corrective action, BOP-SI-5 was revised to remove this requirement from the footnote and place it in the main body of the procedure. This revision to the BOP-SI-5 step was flagged as the Station commitment mentioned in Section C of this LER.

G. Component Failure Data:

Not Applicable

(If more space is required, use additional copies of NRC Form 366A)(17)

FIGURE 1

1SI8802A	Motor Operated Valve (MOV) SI to A&D Hot Leg Isolation Valve
1SI8802B	MOV SI to BC Hot Leg Isolation Valve
1SI8821A	MOV SI Pump A to Cold Leg Isolation Valve
1SI8821B	MOV SI Pump B to Cold Leg Isolation Valve
1SI8835	MOV SI Pumps to Cold Leg Isolation Valve

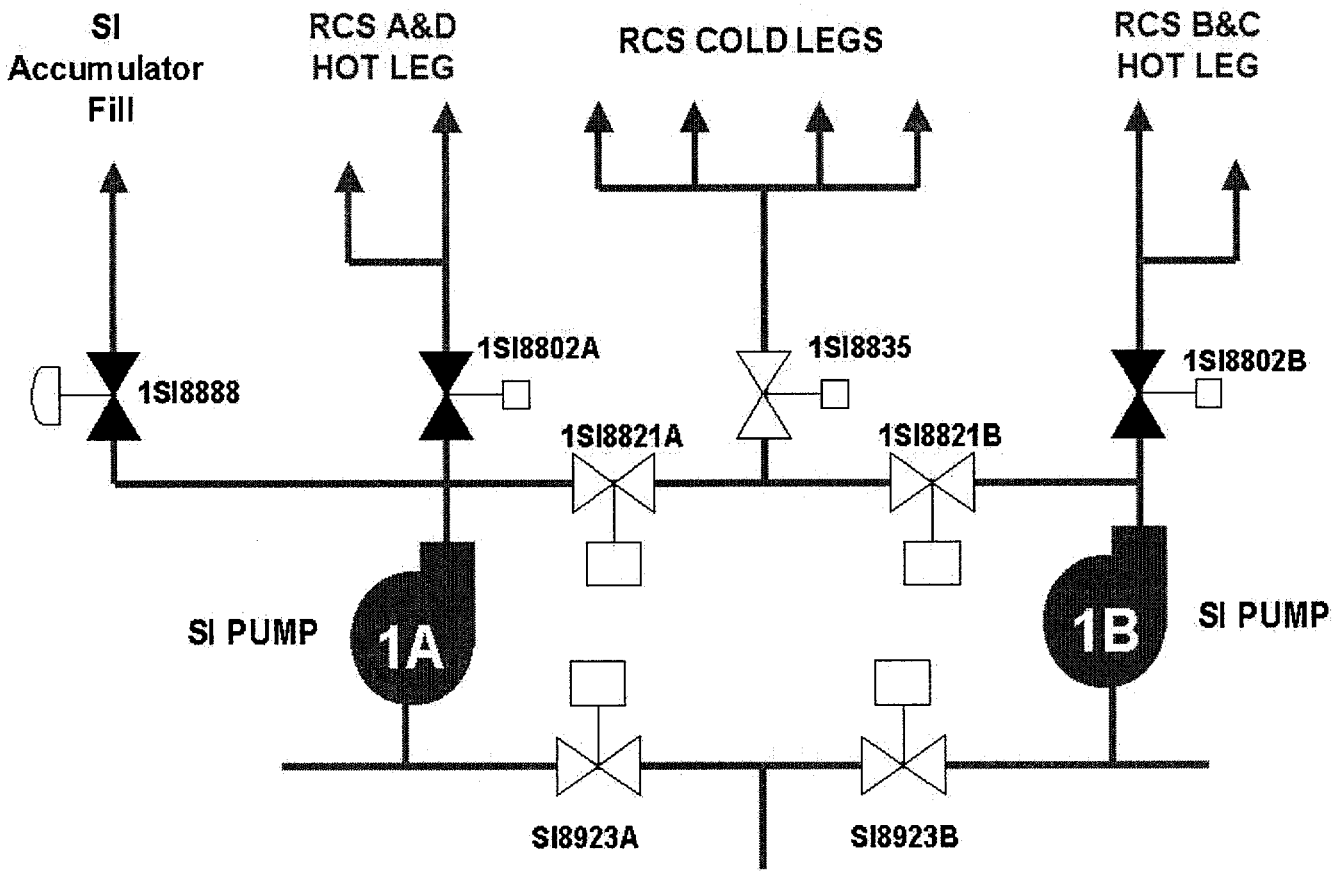

FIGURE 1 - Simplified Diagram of SI Flowpaths to the RCS